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ACADEMIC TRAINING

Carnegie-Mellon University, B.S. 1968

Carnegie-Mellon University, Ph.D. 1975

Thesis: Strong Interaction Effects in Kaonic and Antiprotonic Atoms

PROFESSIONAL EMPLOYMENT

Oct. 1974-Nov. 1976 Physics Research Associate, California Institute of Technology

Nov. 1976-Sept. 1979 Physicist, Lawrence Berkeley Laboratory

Sept. 1979-Sept. 1985 Assistant Professor of Physics, Boston University

Sept. 1985- Sept. 1990 Associate Professor of Physics, Boston University

Sept. 1990-present Professor of Physics, Boston University

RESEARCH EXPERIENCE

RECENT RESEARCH:

I am currently serving as co-spokesman of the Mu2e Experiment at Fermilab. The collaboration now consists of 200 scientists from 26 institutes. Mu2e is a new precision measurement of a rare muon decay mode, muon to electron conversion, This process, which has not yet been observed, is an example of charged lepton number violation, which is very sensitive to many proposed kinds of new physics beyond the usual Standard Model of particle physics. The goal of Mu2e is to improve on the existing limit on muon to electron conversion by four orders of magnitude. This project has consistently received very high marks for its potential physics impact. Mu2e received full contruction approval from the DOE in July 2016, The construction of the building was just completed in December 2016. I am leading the design of the Stopping target and the Stopping Target Monitor, as well as providing overall leadership as co-spokesman.

I am also a member of a team that is developing an improved version of the Muon g-2 experiment is also being developed at Fermilab. Together with Mu2e, it will be situated at the new Muon Facility. The goal is to improve on the current accuracy of the muon anomaly by a factor of four, sharpening the comparison between theory and experiment. Muon g-2 will begin commisioning and data taking in June 2017.

I am an active participant in the AlCap Experiment. There were two data runs at the Paul Scherrer Institut near Zurich, Switzerland in June and in November 2016. The goal is to measure some of the backgrounds as part of the design of the Mu2e Experiment. I am working with one postdoc and one graduate student on the data analysis.

POSTDOCTORAL FELLOWSHIPS: At Caltech, I participated in muonic, pionic, and antiprotonic atom studies to obtain information on nuclear radii, quadrupole and hexadecapole moments, and strong interaction effects. I also participated in precision measurements of μ^- and π^- x-ray energies with a curved crystal spectrometer. At LBL I studied experimentally radiative pion capture at LAMPF and two-pion correlations following heavy ion collisions at the Bevelac.

GRADUATE STUDENT: I participated in kaonic and antiprotonic atom studies at Argonne and Brookhaven National Laboratories, (π, p) and $(\pi, 2p)$ scattering experiments at Lawrence Berkeley Laboratory, and low energy proton and deuteron scattering experiments at the University of Pittsburgh. I also participated in the first measurement of the Σ^- magnetic moment.

PAST RESEARCH: When I first came to Boston U., I was part of a new experimental effort which resulted in the highest precision measurement of the Σ^- magnetic moment to date (performed at Brookhaven National Laboratory), and coherent photo- π^0 production measurements on ^4He near the Δ resonance (performed at the MIT-Bates Linear Accelerator).

I conceived and developed the first ever series of measurements of elastic photon scattering from nuclei above pion threshold through the Δ-resonance region. I was spokesman for the first set of measurements, at the Bates Linear Accelerator, 1986-1988. Data at 180 MeV and 300 MeV have been published, the higher energy data having been taken with a new large NaI detector, which I designed. This was the first calorimeter with high resolution at photon energies above 100 MeV, and the design has been copied many times. The detector was a proof of principle that high resolution measurements of showering particles were possible with calorimeters. I was co-spokesman along with E. C. Booth on a continuation of these Compton scattering measurements at The Saskatchewan Accelerator Laboratory. Data have been published at energies of 160 to 300 MeV on hydrogen, helium, and carbon. The detector was moved to TRIUMF, where a series of radiative pion capture experiments are being performed. It then returned to SAL for more photon scattering experiments. In 2005, the detector was moved to Lund, Sweden, where it is being used to measure the electric and magnetic polarizability of the neutron.

I was co-leader for an experiment at BNL to measure radiative kaon capture on the proton and the weak radiative decay rates for the Λ and Σ^+ particles, which finished taking data in 1989. The Boston University NaI detector played a central role in the first set of these measurements at Brookhaven. Several papers have been published on this data.

Along with two other members of our research group, I was part of an experiment at CERN in Geneva, Switzerland to measure the parameters of CP violation in neutral kaon decays. This experiment brought a unique approach to the measurements of these parameters, and it has provided the best values for a number of them. I led the Boston University effort, which developed the time-of-flight counters and fast electronics for Cerenkov and scintillator readout. I led the development of a state-of-the-art 12 bit TDC with a 1 microsecond conversion and readout time, and directed the design of a fast readout controller for the ADC's as well. This experiment completed data taking in 1995.

I have been a major participant and one of the leaders of the Muon g-2 measurement at Brookhaven, which took its first data in the Spring of 1997, and has taken data runs in 1998, 1999, 2000, and 2001. At the planned very high precision of the measurement, g-2 is sensitive to substructure of the muon, and to the presence of physics beyond the standard model, for example supersymmetry. Much of the physics reach of the g-2 experiment meets or exceeds that of the present or planned high energy facilities. Our research group at Boston University developed the detectors and the necessary high-precision electronics for this experiment. I was head of the detector subgroup, which established the design and developed and installed the entire detector system and custom electronics for the experiment. The Boston University group built all of the custom electronics, which included wave-form digitizers and multi-hit time-to-digital converters, and special, gain-stabilized, gated photomultiplier bases. The results of the analysis of the all of the data sets pertaining to the muon magnetic anomaly have been published as of 2006. The result om the anomaly received worldwide attention because it was in disagreement with the Standard Model of particle physics by more than 2.5 standard deviations. I was analysis coordinator for the precession frequency analyses of the 1999 and 2000 data sets, and I have served as chair of the experiment's executive committee for the last 5 years.

I worked with other members of our research group at BU to carry out an experiment at the Paul Scherrer Institute in Switzerland to measure the lifetime of the muon to unprecedented accuracy. The experiment has completed and published its final results in 2014. Such a measurement has greatly improved our knowledge of G_F, the Fermi constant, which is one of the most important parameters in the Standard Model.

PUBLICATIONS

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